

DIVISION 16

ELECTRICAL

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ARCHITECTURE
INTERIOR DESIGN
PLANNING



SECTION 16010

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including general and special conditions and general requirements, apply to the work specified in DIVISION 16 - ELECTRICAL.

B. Separation of Division 16 into Sections is for convenience only and is not intended to establish limits of work. Sections are as follows:

16010 ELECTRICAL GENERAL PROVISIONS

16100 ELECTRICAL BASIC MATERIALS AND METHODS

16400 ELECTRICAL SERVICE AND DISTRIBUTION SYSTEMS

16500 ELECTRICAL LIGHTING

16600 ELECTRICAL SPECIAL SYSTEMS

1.2 SCOPE

A. The work under this Section includes furnishing and installing wires, conductors, cables, conduit and conduit fittings, wiring devices, junction and outlet boxes, panelboards, circuit breakers, fuses, relays, safety switches, lighting fixtures, lamps, cabinets, grounding connections, emergency lighting system, automatic transfer switches, raceways for telephone outlets, raceways for computer outlets, fire alarm system, paging system, nurse call and code blue systems, raceways for CATV outlets, raceways for cameras (TV and infrared), intercom system, transformers, and other equipment specified or necessary for a complete installation. The work also includes making building modifications if necessary to get these items to the locations for installation.

B. Also included in the work is the power wiring for other items indicated on the architectural plans, as well as power wiring for the equipment specified in DIVISION 15 - MECHANICAL.

C. Roughing-in only, to the extent indicated on the drawings, shall be provided for other equipment.

D. Removal of existing electrical equipment not being reused.

1.3 CUTTING AND PATCHING

A. Contractor shall do his work in such a way to avoid cutting where possible. Holes cut shall be patched in a suitable manner and shall be refinished to match the existing finish. Holes cut in exterior

walls shall be patched, flashed, and completely waterproofed. Contractor shall patch and/or repair walls, ceilings, and floors where existing equipment is removed.

B. Cutting and patching for the work of this Division shall be in accordance with the requirements of the General Conditions. Openings around conduit penetrations shall be sealed.

C. Work of this Division shall include providing information for any required openings to those responsible for concrete slabs and other concrete members.

D. Field cut openings in concrete shall be located to avoid the reinforcing. Locations shall be subject to approval of the Architect.

E. No structural members shall be field cut or pierced without the approval of the Architect.

F. Inserts in slabs and beams for fastening work shall be drilled type.

G. For post-tensioned slabs and beams, inserts for fastening work shall be cast in place wherever possible. If additional inserts are required after concrete is placed, drilled type shall be used. Drilling shall not penetrate the post-tensioning tendons. Powder driver fasteners shall not be used.

H. Grouting shall be provided around raceway penetrations through concrete floors equal to the fire rating of the floor (this shall also inhibit water from leaking through the floor).

1.4 DRAWINGS

A. Outlets shown on electrical drawings are located approximately only. Refer to architectural drawings for necessary dimensions. Refer to architectural, structural, and mechanical drawings as well as equipment manufacturer's shop drawings and rough-in drawings, and adjust work accordingly to provide a coordinated installation. Contractor shall install fire alarm devices as near as possible to the locations indicated on the drawings but shall move them as necessary to avoid conflicts with existing equipment and to be located sufficiently away from hot objects.

B. Smoke detectors and heat detectors shall be located so that the maximum distance between detectors is 30'-0", and the maximum distance from walls is 15'-0". Locations shall conform to other restrictions of NFPA 72 to include the requirement that smoke detectors be kept at least 36" away from HVAC grilles. Contractor shall plan for contingencies in connection therewith to include providing additional smoke detectors and heat detectors.

C. Visual signal unit and audiovisual signal unit locations shall be adjusted as necessary to avoid conflicts with other equipment. Contractor shall plan for contingencies in connection therewith to providing additional signal units.

D. Visual signal unit and audiovisual signal unit locations shall be adjusted as may be necessary to meet NFPA 72 paragraphs 4-4.4.1 and 4-4.4.2.

1.5 LAWS AND PERMITS

A. The National Electrical Code (2005) and State, Parish, City and local building codes shall be considered a part of these specifications, and pertinent articles will not be repeated herein. These codes

shall establish the minimum acceptable criteria where more stringent requirements have not been defined in these specifications and/or drawings.

- B. The Contractor shall apply for permits and pay inspection fees incidental to electrical work.
- C. No work shall be concealed until approved by the local inspector and local regulations shall be adhered to.
- D. Upon completion, a certificate of approval from the appropriate regulatory agency shall be furnished to the Architect.

1.6 VISITING SITE

The bidder shall visit the site of proposed work so that he may understand the facilities, difficulties, and restrictions attending the execution of the contract. He will be allowed no additional compensation for failure to be so informed.

1.7 INTERRUPTION OF SERVICES

Services in existing building are to be kept in operation at all times, except when specific permission is given to do otherwise. Before any services are interrupted, arrangements shall be made with the occupants to do this work at a time most convenient to them. This procedure may involve working at night, on Saturday or Sunday, or at a special time of the year, with the length of time of the interruption agreed upon in advance. Once any service is interrupted, work to restore the service in the shortest possible time shall be on a continuous basis unless temporary service is provided or approval is obtained from the Owner to do otherwise. Any temporary services required shall be work of this Division. Allowance shall be made in the Contractor's bid for the cost of any overtime work in this connection.

1.8 GUARANTEE

The Contractor shall guarantee materials and workmanship for one year after final acceptance of entire project unless a longer guarantee is indicated hereinafter for specific equipment.

PART 2 - PRODUCTS

2.1 MATERIAL AND WORKMANSHIP

Equipment and materials shall be new and shall be listed by Underwriters Laboratories, Inc. in categories for which standards have been set by that agency. Whenever two or more of the same product are indicated, they shall be of the same manufacturer. In particular, panelboards shall be of the same manufacturer. Methods of installation shall be in full accord with the latest and best electrical and mechanical engineering practices.

2.2 SUBSTITUTIONS

A. Names of manufacturers or catalog numbers are mentioned herein in order to establish a standard as to design and quality. Other products similar in design and of equal quality may be used if

submitted to the Architect and found acceptable by him. Refer to General Conditions for additional information.

B. When the Contractor elects to use an acceptable alternate manufacturer's equipment, the Contractor shall be responsible to coordinate the change with the trades affected. The Contractor shall also pay for any additional work required under this Division as well as any other Division if the alternate equipment is used.

C. Lighting fixture substitutions shall also be similar in appearance, construction and photometrics (photometric information shall be based on independent laboratory reports) to specified lighting fixtures.

D. If required by Architect because of substitutions, the Contractor shall submit for approval 1/4" scale working drawings of equipment areas with both plan and Section views.

2.3 SUBMITTALS

A. Within 30 days after award of contract, the Contractor shall submit for review six copies of descriptive literature or shop drawings for the following material which he proposes to use:

Lamps.	Circuit breakers.
Wiring devices and plates.	Intercom system.
Panelboards.	Fire alarm system.
Fuses.	Paging system.
Safety switches.	Nurse call system.
Lighting fixtures.	Code blue system.
Automatic transfer switches.	Cable television system.
	Transformers.

B. In addition, the name of the manufacturer of conduit, E.M.T., and conductors to be used shall be submitted for review.

C. Where applicable, submissions shall include installation drawings and brochures showing locations, methods of anchoring, connections to work of others, wall or ceiling conditions at each particular installation and special floor mounting conditions.

D. Submissions shall be identified with project name, equipment name and number (if assigned a number) same as the name and number indicated on the drawings; shall be properly marked to show model numbers and any accessories being furnished; and shall have the Contractor's stamp showing he has reviewed the submittal and found it to be in accordance with the specifications and drawings. Items of Division 16 to be submitted shall be submitted in one package.

E. Submittals which do not comply with the above will be returned without review, for resubmittal.

PART 3 - EXECUTION

3.1 RECORD DRAWINGS

At the completion of the work, unless noted otherwise in the General Conditions, mark-up a mylar reproducible and two sets of blueprints in a neat and understandable manner to show significant changes made during construction. Wiring and raceways installed shall be indicated (routings, wire size and quantity) on the record drawings even if not indicated on the contract drawings. Final payment will be withheld until these drawings are furnished to the Architect. The Contractor shall pay for the reproduction costs.

3.2 OPERATING INSTRUCTIONS

A. Before final acceptance, prepare and deliver to the Architect two bound copies of operating instructions, which shall include:

1. Description of major components of power systems and each special system, including the function of major items.
2. Detailed operating instructions and instructions for making routine minor adjustments.
3. Routine maintenance operations.
4. Manufacturer's catalog data and service instructions and parts list for each piece of operating equipment.
5. Final reviewed submittals.

B. Instruct Owner in the care and operation of equipment and shall provide the services of a competent mechanic for this purpose.

C. Literature shall be substantially bound in a suitable number of volumes so as to permit heavy usage and shall include wiring diagrams, fabrication drawings and other information as may be required.

3.3 MECHANICAL EQUIPMENT

A. Electrical work in connection with DIVISION 15 - MECHANICAL required but not indicated as work of DIVISION 16 - ELECTRICAL shall be work of DIVISION 15 - MECHANICAL. Except as may be hereinafter indicated, control wiring will be done as work of DIVISION 15 - MECHANICAL.

B. Work of other Divisions will include furnishing and setting motors, except that V-belt drive motors shall be set as work of this Division.

C. Unless indicated otherwise, magnetic starters (including variable speed drives) will be furnished under other Divisions for installation under this Division.

D. Overload elements in starters shall be selected according to actual motor nameplate full load current. Responsibility for this coordination shall lie with the Division under which the particular starter is furnished.

E. Unless indicated otherwise, power disconnect switches and single speed manual starting switches shall be furnished and installed under this Division. Where combination magnetic starters are provided as work of another Division, the associated disconnect switch will be furnished as work of that Division. Disconnect switches for control wiring will be furnished and installed under DIVISION 15 - MECHANICAL.

F. Where Division 15 schedules indicate that equipment is furnished with a disconnect, the disconnect shall be installed and connected as work of Division 16.

G. Firestats for single phase fans will be furnished and set under DIVISION 15 - MECHANICAL, and electrically connected in the branch circuit wiring as work of this Division. Any other control wiring, including temperature control wiring, high voltage interlocking, start-stop wiring, together with conduit for same, will be furnished and installed under DIVISION 15 - MECHANICAL; this includes, but is not limited to, thermostats, damper motors, aquastats, firestats, push buttons, selector switches, control power transformers, control panel, etc.

H. Refer to DIVISION 15 - MECHANICAL, and to mechanical drawings for any additional electrical power work required.

3.4 WORK RELATED TO EQUIPMENT NOT FURNISHED AS WORK OF THIS DIVISION

Unless specifically indicated otherwise, any required electrical services for and required electrical connections to items shown on the architectural drawings or specified to be furnished in other Divisions of specification or by Owner shall be electrically connected as work of this Division.

3.5 PAINTING

Painting, including painting of exposed conduit is specified under DIVISION 9 - FINISHES. Damaged surfaces of factory-finished items, however, shall be repaired to the satisfaction of the Architect as the work of this Division.

3.6 PROTECTION OF WORK

Protect the equipment, fixtures, and work from damage. Damaged work will be rejected and replaced at the expense of the Contractor. Lighting fixtures, panels and similar equipment shall likewise be protected from damage and from the weather. Provide adequate and proper storage facilities for such items during the progress of the work.

3.7 BUILDING CODE RESTRICTIONS

Contractor shall assure that he does not install electrical equipment including raceways in or through areas restricted by the building codes. These areas include elevator shafts and stairs.

3.8 EXISTING WORK

A. Remove existing lighting fixtures from areas affected by new construction and from areas to be relighted. After completion of work in a given area, the Contractor shall reinstall the existing lighting fixtures or install new lighting fixtures as indicated.

B. Where existing ceilings are being removed, provide new supports for any raceways, outlets, junction boxes, or any other electrical items which are to remain and which depend upon the existing ceiling suspension system for support. The new supports shall be attached to the structure/slab above.

C. Existing outlets not to be reused shall be removed unless directed otherwise. Where outlets are indicated to remain as junction boxes, wall outlets shall be provided with blank device plates of the type hereinafter specified and ceiling outlets shall be provided with Yorkville #76 covers where fixture studs exist and #176 where there are no studs.

D. Where new wall or ceiling finishes are applied, existing equipment and cover plates for wiring devices, junction boxes, telephone outlets and data outlets, etc., shall be removed and reinstalled. Provide extension rings on outlets to remain, where necessary. New cover plates shall also be installed on boxes that do not contain cover plates. Existing outlets, boxes, etc., are not shown on the drawings; bidder shall visit the site to locate these.

E. Existing exposed conduit or other electrical equipment not to be reused shall be removed. Existing conduit not to be reused and located in accessible attic spaces also shall be removed.

F. Existing conduits in good condition (and of the type and size required) may be reused. Existing conductors, wall switches and receptacles which are required to be removed, unless otherwise individually indicated, shall not be reused.

G. Electrical equipment removed and not to be reused shall be stored in one location on the site; any equipment and material which the Owner does not wish to retain shall become the property of the Contractor and shall be removed from the site by him.

H. Where apparent routings of existing raceways are indicated, it is not possible to guarantee that these routings are correct. The Contractor shall allow for contingencies.

I. Where existing raceways are indicated to be reused, it is not possible to guarantee that the existing raceways are in suitable condition to be reused. Before conductors are installed in existing raceways, the raceways shall be cleaned out and a try-plug $\frac{1}{4}$ " smaller than the inside diameter of the raceway pulled through to assure continuity. Raceways which are found to be broken, blocked, and/or defective in any way shall have the defective sections replaced or entirely new raceway provided with routing subject to approval of the Architect. The Contractor shall allow for contingencies in connection therewith.

J. Where outlets to remain are fed from outlets in partitions to be removed, or ceilings and walls to which new finishes are to be applied, the Contractor shall provide such new homeruns or other rerouting as may be required by job conditions to insure service to the outlets to remain.

K. Where existing equipment including wiring and raceways is in conflict with work of this project, Contractor shall rework/reroute/relocate this equipment as necessary.

L. Remove existing electrical equipment (including but not limited to fire alarm panels, communication panels, etc.) that might be damaged during construction unless the Owner prefers that this equipment be kept in operation during construction. Reinstall, test and put equipment back in proper working order unless indicated otherwise. The Contractor should (for his protection) test the equipment prior to removal to insure that the equipment operates properly; the Owner should be notified in writing of any existing malfunctions.

M. Since a portion of the existing building will be occupied during construction, Contractor shall provide temporary fire alarm protection in the renovated areas during construction. Maintain system during construction.

END OF SECTION

SECTION 16100

ELECTRICAL BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SCOPE

Work described in this Section includes providing labor, materials and equipment indicated, specified and necessary for a complete and operating electrical system and related systems in accordance with SECTION 16010 - ELECTRICAL GENERAL PROVISIONS.

PART 2 - PRODUCTS

2.1 CONDUIT AND TUBING

A. Rigid steel conduit and electrical metallic tubing shall be manufactured by Allied, Triangle-PWC, Republic, Wheatland, or approved equal. Conduit shall be threaded heavy wall hot-dipped galvanized (inside and out) steel conduit. Electrical metallic tubing shall have galvanized exterior and galvanized or equivalent plastic coated interior to protect against corrosion.

B. Rigid aluminum conduit shall be manufactured by New Jersey Aluminum, or VAW of America from 6063-T42 extruded Schedule 40 pipe. The interior surface shall be coated with special approved lubricating liner.

2.2 CONDUCTORS

A. Conductors shall be copper.

B. Branch circuit wiring shall be #12 AWG or larger (as required for the particular equipment to be fed) with flame resistant insulation. Conductors #8 AWG and larger shall be stranded. Insulation on branch circuit conductors shall be type THHN/THWN, unless indicated otherwise or otherwise required by the particular application.

C. Feeds to surface and/or suspended fluorescent fixtures shall be #12 AWG type THHN/THWN. Wiring through channels of continuous rows shall be #12 AWG and type THHN/THWN, or XHHW. Recessed fluorescent fixtures shall be fed with #12 AWG type THHN/THWN or type XHHW conductors.

D. Surface mounted high intensity discharge (HID) lighting fixtures shall be fed with #12 AWG type THHN/THWN unless higher temperature rated conductors are required for the particular fixtures provided. Recessed HID fixtures shall be fed with type SF-2, SFF-2, PF, or PFF unless complete with prewired outlet box approved for type THHN/THWN conductors. Lighting standards shall be wired with type THHN/THWN from wiring handhole in standard to fixtures unless higher temperature conductors are required for the particular fixtures provided.

- E. Feeders shall be of the size as indicated, with type THHN/THWN insulation unless indicated otherwise.
- F. Except as may be otherwise indicated, conductors shall be manufactured by Triangle-PWC, American Insulated Wire, Senator, Royal, or approved equal.

2.3 OUTLETS

- A. All boxes, fittings and supports (including wireways) shall be galvanized steel.
- B. Boxes for concealed wall outlets shall be 4" square by 1½" deep, or larger, with raised device covers, except that 2¾" deep switch boxes may be used, unless noted otherwise, where only one conduit enters a box. Device covers for 4" square boxes in masonry walls which are not plastered or otherwise finished shall be 1" minimum in depth with straight rectangular openings for dry wall type construction. Covers for boxes in sheetrock or wood walls shall be of the same depth as the sheetrock or wood thickness and shall have straight rectangular openings.
- C. Where 4" junction boxes are indicated or installed, they shall be complete with raised device covers as hereinbefore specified. Blank plates shall be as specified for devices.
- D. Boxes for concealed ceiling outlets shall be 4" octagonal by 1½" deep, or larger. Boxes in plaster ceilings shall have plaster covers. Fixture outlet boxes shall be equipped with fixture studs secured to the boxes. Boxes above lay-in ceilings shall be supported by bar hangers or other suitable means; they shall not be supported by ceiling tiles.
- E. Outlet boxes for exposed work at dry locations inside buildings shall be 4" square x 1½" deep or larger with Appleton ½" deep raised surface metal covers to accommodate the devices indicated. Outlet boxes for exposed work exposed to weather or in damp locations shall be of cast or malleable iron, similar to Crouse-Hinds type FS or FD condulets. Boxes shall have metal covers to accommodate the devices indicated.
- F. In walls or ceilings of concrete, tile, or other noncombustible material, boxes and fittings shall be so installed that the front edge of the box or fitting will not set back of the finished surface more than ¼". In walls or ceilings constructed of wood or other combustible material, outlet boxes and fittings shall be set flush with the finished surface. If a fixture canopy or pan is used as an outlet box cover, any combustible wall or ceiling finish between the edge of the canopy and the outlet box shall be covered with noncombustible material.
- G. For conduits 1" and smaller, the following shall be the maximum number of conductors permitted in a box:

<u>Trade Size</u>	<u>Max. No. #12</u>
1-1/2" x 4" octagonal	6
1-1/2" x 4" square	9
1-1/2" x 4-11/16" square	12
2-1/8" x 4-11/16" square	16
2-3/4" x 3" x 2"	6
3-1/2" x 3" x 2"	8

H. Where a fixture stud is installed in box, the number of conductors permitted shall be reduced by one. Where a wiring device is installed in box, the number of conductors permitted shall be reduced by two. A conductor running through the box is counted as one conductor, and each conductor terminating in box is counted as one conductor.

I. Outlet boxes installed flush mounted in stud partitions shall be installed in such a way that boxes between any two studs shall penetrate only one wall face. Outlet boxes that penetrate opposite wall face shall be located between adjacent studs (to reduce noise transmission through walls).

2.4 WIRING DEVICES

A. Wiring devices shall be as manufactured by P&S/Sierra, Hubbell, Leviton, or Eagle. Comparable catalog numbers of devices furnished shall conform with the following:

1. Duplex receptacles 20A/2 pole, 3-wire, 125 volt, grounding type, hospital grade — Hubbell #8300-W. Face shall be nylon or polycarbonate. In sleep lab, use Hubbell #5362-I.
2. GFI duplex receptacles 20A/2 pole, 3-wire, 125 volt, grounding type, hospital grade — Hubbell GF8300-W. In sleep lab, use Hubbell #GF5362-I.
3. Wall switches 20A/1 pole — Hubbell #HBL1221-W, or equal. In sleep lab, use Hubbell #HBL 1221-I or equal.
4. Wall switches 20A, 3-way — Hubbell #HBL1223-W, or equal. In sleep lab, use Hubbell #HBL 1223-I or equal.
5. Dimmer switch, Lutron Nova T (white) NF-10-277 series; slide type for fluorescent.
6. For sleep lamp — Wiring devices shall match existing.

B. All 20A/2 pole, 3-wire receptacles shall be mounted with a "U" shaped grounding connection at the top, except for weatherproof receptacles, and except for locations where existing receptacles are mounted with "U" shaped grounding connection at the bottom.

C. Where duplex receptacles are indicated to be located as required for electric water cooler and electronic faucets at lavatories, they shall be located where indicated on electric water cooler shop drawings and faucet shop drawings.

D. Wiring devices connected to branch circuits which are part of the emergency system (critical branch and life safety branch) and/or equipment system usually served by an on-site engine-generator shall have red finish (similar to Hubbell HBL1221-R). Most of these devices are identified on the drawings by the usual device symbols with an "E" next to them, or otherwise specifically indicated. In addition each device plate shall be engraved with red filled letters to read "EMERGENCY" at top of plate, and the panel designation of the circuit (including circuit breaker number) serving the device engraved at the bottom of plate (examples — "1LLS3" and "2LCB12").

E. All dimmer switches shall be of the same manufacturer, unless indicated otherwise.

F. Unless indicated otherwise, lighting fixtures within each room shall be switched by the wall switch or switches indicated in the room.

2.5 DEVICE PLATES

A. Plates shall be of the one-piece type, P&S/Sierra "S-1N" line or Slater "SSA" line with #302 (non-magnetic) satin stainless steel finish.

B. For sleep lab, device plates shall match existing.

C. Where weatherproof switches are indicated, P&S/Sierra type 302 series WP plates shall be used, unless indicated otherwise on drawings.

D. Where weatherproof receptacles are indicated, metal canopy-type weatherproof covers similar to T&B Red Dot Code-Keeper (UL listed for wet locations at all times) shall be used, unless indicated otherwise on drawings.

E. Use multi-gang plates where switches, receptacles, and/or other devices are grouped.

F. Plates shall be installed with the four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16" from the vertical or horizontal.

G. Plates for devices fed with exposed conduit shall be as hereinbefore specified.

H. Wherever a series of switches or pilot lights and switches are grouped, the plates shall be furnished with suitable factory engravings (black filled). Where engraving of dimmer switch plates is impractical, engraved phenolic strips may be installed. Engravings shall indicate function/location names not subscript shown on drawings (names shall be approved by Architect).

I. Device plates shall not be installed until painting is completed. Device plates having paint on their surfaces, or having their finish marred by use of paint remover, shall be replaced at no additional cost to the Owner.

2.6 SAFETY SWITCHES

A. Safety switches shall be of the quick-make, quick-break visible blade-knife switch type. They shall be of the fused or nonfused type as required. Fused switches shall have positive pressure fuse clips. Heavy duty switches shall be fully interlocked, with provision to neutralize the interlock by a screw driver while under load without interrupting the circuit. Switches shall be complete with insulated base, and pressure or solderless lugs (suitable for use with 75 degrees C conductors). Handles shall be front or side operated. Switches shall be horsepower rated, capable of breaking stalled-rotor motor current at these ratings. Unless noted otherwise, outdoor locations shall have NEMA type 3R enclosures; indoor locations shall have NEMA I enclosures. Switches shall have provision for padlocking in the "off" position. 600 ampere or smaller switches shall be complete with rejection feature to insure rejection of fuses other than Class R. Safety switches shall be Square D General duty for 208-240 volt non-fused switches and Heavy duty for 480 volt switches and 208-240 volt fused switches. Equal equipment as manufactured by GE, Siemens or Westinghouse will be acceptable.

B. Non-fused disconnect switches for single phase motors may be Hubbell #HBL1221 20A/1P horsepower rated (for 115V motors) or #HBL1222 20A/2P horsepower rated (for 208-240 motors) as required; in outdoor locations these switches shall be mounted in FS condulets with #DS 185 covers and gaskets.

2.7 FUSES

Provide one complete set of fuses, together with 33% spares, for each fuseholder. Fuses 600A and below shall be Buss Low-Peak, Littlefuse Little Peak, or Gould Shawmut Amtrap II, Type RK-1, current limiting and time delay, rejection type, unless noted otherwise. Fuses above 600A shall be Buss Low-Peak, Littlefuse KLP-C or Gould Shawmut Amtrap, UL listed Class L, current limiting and time delay, with 200,000 amp rms interrupting rating, silver plated contact surfaces. Where fuses are used with magnetic starters, fuses shall be reduced in ampere rating (from the sizes indicated) to the maximum rating allowed for each particular starter, as stated on starter nameplate.

2.8 AUTOMATIC STARTING AND AUTOMATIC TRANSFER SWITCH

A. There shall be one automatic transfer switch associated with existing generator No. 4. It shall be a 4-pole switch rated 277/480V, 3-phase, 4-wire.

B. Automatic transfer switch shall be rated 400 amperes RMS continuous duty in enclosure, and shall be fully rated 400 amperes RMS continuous) in enclosure without derating to transfer any type of loads, inductive and/or resistive. It shall be contained in a NEMA I enclosure with door, door handle, and key operated lock. Locks shall be keyed alike.

C. Automatic transfer switch shall have a minimum withstand current rating of 65,000 amperes RMS symmetrical at 480V when used with circuit breakers and 200,000 amperes RMS symmetrical at 480V when used with RK-1 fuses. Switch shall be mechanically held in both normal and emergency positions and shall be electrically and mechanically interlocked to positively prevent the load from being energized simultaneously by normal and standby power. The special silver alloy contacts shall be enclosed in arc-chambers that confine and extinguish breaking arcs in less than one-half cycle and prevent any cross arcing. The operating transfer time in either direction shall not exceed one-sixth (1/6) of a second. Replaceable contacts, coils, springs and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors. Sensing and control relays shall be continuous duty industrial control grade type with a minimum contact rating of ten amperes. Automatic transfer switches utilizing components of molded case circuit breakers, contactors, or parts thereof which have not been intended for continuous duty or repetitive load transfer switching are not acceptable. The switch shall be capable of being switched manually while under load with permanently mounted operating handle.

D. Automatic starting shall be actuated upon signal of loss of normal power from automatic transfer switch. Return of normal power shall open the start-stop circuit again, stopping the plant (with time delay adjustable from 0 to 10 minutes). The start control circuit shall include a time delay adjustable from 1 to 6 seconds on plant starting.

E. Automatic transfer switch shall include in each phase an adjustable low voltage sensitive relay with solid state sensing circuit with pickup adjustable from 85% to 98% of nominal line voltage, and dropout values adjustable from 2% to 25% below the pickup voltage setting. Transfer shall occur only after plant attains a minimum of approximately 85 to 90 percent of rated speed and voltage (with time delay

adjustable from 0 to 120 seconds). There shall be an adjustable time delay for retransfer to normal power of 0 to 30 minutes. If engine-generator fails during this delay period, the time delay shall be by-passed and the load instantly retransferred to normal power. Operating current for transfer shall be obtained from the source to which the load is to be transferred. Transfer switch shall have a test switch which will simulate a power failure (in control circuit) and cause the engine generator to start; and selector switch (with load/without load) for test/exercise mode. Transfer switch shall require only front access for maintenance. It shall have in cover white (Normal Available) and yellow (Emergency Available) pilot lights. It shall have a green (Normal Position) and a red (Emergency Position) pilot light. Pilot lights shall be long life neon type. There shall be a voltmeter and ammeter. Time delay relays shall be clearly labeled to indicate their use.

F. Automatic transfer switch shall be equipped with a programmed transition option which shall cause the switch to pause in neutral position during transfer and retransfer for an adjustable time delay period of 0 – 7.5 seconds. Switch shall also be equipped with 4 N.O. and 4 N.C. auxiliary contacts to indicate switch position for remote monitoring. There shall also be 2 N.O. and 2 N.C. auxiliary contacts for use in remote monitoring for "Normal Power Available" and "Emergency Power Available".

G. Electrical equipment or apparatus of any one system shall be the product of one manufacturer, or equivalent products of a number of manufacturers which are suitable for use in a unified system. ATS shall meet UL #1008, and shall be equal to Onan Series OT III.

2.9 WARNING SIGNS

A. Standard industry "DANGER HIGH VOLTAGE" warning signs shall be provided as required by the National Electric Code and as follows:

1. On each door of automatic transfer switches.
2. On each removable panel of transformers.
3. On other equipment (such as safety switches, etc.) containing energized components which are exposed when door is opened or access panel is removed.

B. A warning sign "AUTOMATIC STARTING ENGINE GENERATOR" shall be provided on each side of the engine generator housings for existing E/G #1, #2, #3 and #4..

PART 3 - EXECUTION

3.1 METHODS OF WIRING

A. Systems shall be 4-wire, 3-phase, 120/208 volts, A.C., and 4-wire, 3-phase, 277/480 volts, A.C.

B. Provide power wiring as required whether indicated on drawings or not.

C. All wiring run underground or in fill beneath slab shall be contained in rigid threaded heavy wall hot-dipped galvanized (inside and out) steel conduit encased in a 3" minimum thickness concrete envelope. Conduits and concrete envelopes under structural slabs shall be adequately supported from the slab using 3/8" diameter stainless steel rods properly spaced (not greater than 5'-0" spacing between rods)

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Sleep Lab/Founders**

**SA 41035.01
SA 41035.07**

to support the load and to suitably distribute the load within the capacity of the structural slab. The rods shall pass under conduit and rise on both sides to tie into slab.

D. Unless otherwise indicated on drawings or specified hereinafter, wiring installed outdoors (not underground or in fill beneath slab) shall be contained in rigid threaded heavy wall galvanized steel conduit (hot dipped, inside and out).

E. Unless otherwise indicated on drawings or specified hereinafter, other wiring shall be contained in electric metallic tubing for sizes 2" and under, and rigid threaded heavy wall galvanized steel conduit (hot dipped, inside and out) for sizes over 2".

F. Unless specifically indicated otherwise on the drawings, aluminum conduit may be used in lieu of steel conduit, provided same does not run underground or in concrete. Where aluminum conduit is used, fittings, outlet boxes, junction boxes, and accessories shall be aluminum.

G. All raceways shall be concealed unless otherwise indicated.

H. Branch circuit raceways feeding outlets in masonry walls shall be concealed in the masonry. Where outlet boxes are indicated in bare masonry walls, the box shall be mounted so that two edges of the box or plaster cover will fall in a mortar joint. Where switch boxes will not accommodate the number of conductors required and 4" square or larger boxes are installed, provide device covers 1" minimum in depth with straight rectangular openings for dry-wall type construction. Where grouting is required to fill up improperly cut openings in the masonry, the work will be rejected. The work of this section shall be coordinated with the masonry work to insure a neat and workmanlike job.

I. Solderless spring type connectors similar to Scotchlok connectors, Ideal colored Wingnuts, or Ideal Crimps with Wrapcaps shall be used for branch circuit wiring and fixture splice connections. Solderless connectors of the split-bolt type shall be used for splices on conductors #8 and larger.

J. Splices in low voltage wiring (50 volts and less) shall be made at terminal blocks furnished with the equipment. At junctions or where other splices are required, these splices shall be soldered or made with approved compression connectors.

K. Termination of branch circuit and feeder conductors shall be made using mechanical or compression lugs, unless noted otherwise. Where lugs are not furnished with equipment (including Owner-furnished equipment), Contractor shall provide lugs as required for a complete installation.

L. Termination of low voltage wiring (50 volts and less) and control/monitor/instrumentation wiring (120 volts and less) shall be made using compression type (ring or spade) terminal similar to T&B Sta-Kons.

M. Connections to motors and equipment containing motors not equipped with a portable cord shall be made with a short piece of steel flexible metal conduit between rigid conduit system and motor terminal box. Where the motor is located inside a housing, connection between housing and motor terminal box shall be made with a short piece of steel flexible metal conduit, and connection between rigid conduit system and housing shall be with a short piece of steel flexible metal conduit. Ground bond of separate copper conductor shall be made between motor frame and rigid conduit system. In outdoor locations and

other locations subject to moisture or water leakage (such as for pumps), liquid-tight flexible metal conduit shall be used. Wiring within these flexible metal conduits shall be stranded.

N. Taps in feed-thru panelboards and/or wireways and junction boxes shall be made with OZ gutter taps, complete with bakelite covers.

O. Recessed fluorescent fixtures shall be wired with #12 AWG type RHH, THHN, or XHHW conductors in 4 to 6 feet of ½" flexible metal conduit from a box at least 1 foot from the fixture. Recessed compact fluorescent, and H.I.D. fixtures shall be wired with conductors as heretofore specified in 4 to 6 feet of flexible metal conduit from a box at least 1 foot from the fixture, unless the fixture is of the pre-wired type with an integral outlet box approved for the number and type of branch circuit conductors indicated and/or specified. Not more than two individual fixtures shall be connected to any of these outlet boxes. This box shall be located above the ceiling and shall be accessible from attic, by removing acoustical tile in accessible ceiling or by removing fixture in a non-accessible ceiling. Installing blank covers on ceilings to provide access to such boxes will not be acceptable.

P. Typewritten directory of circuits shall be provided for each panelboard. The room numbers and items served shall be indicated for each circuit. (Circuit numbers indicated on the drawings are shown for the purpose of clarifying the grouping of outlets. The actual number assigned to the circuits in the panelboard shall suit the bussing and branch circuiting to the panelboard.) In existing panelboards, the directories shall be corrected as required for changes made to the circuits. Phenolic nameplates (white with black-cut letters) shall be provided in lieu of directories for changes to switchboards, motor control centers, and fusible panelboards.

Q. Branch circuit wiring through lighting fixtures shall be in accordance with Articles 410.11, 410.31, 410.32, and 410.33 of the National Electrical Code; however, conductor types shall be as specified hereinbefore.

R. Unless a larger size is indicated, raceways shall be sized in accordance with Chapter 9, Table 3C, of the 1993 edition of the National Electrical Code for the number and conductor size (AWG and MCM) shown or specified. Where combination of secondary (0-600 volt) conductor sizes are indicated, the raceway shall be sized in accordance with the 1993 edition of the National Electrical Code, Chapter 9, Table 4 based on the areas of Table 5, Column 3 for the project conductor sizes (AWG and MCM) indicated even though the insulation indicated or specified may differ from those in the heading of Column 3.

S. In 277/480 volt systems, wall switches grouped or ganged in an outlet box shall be so arranged that voltage between adjacent switches does not exceed 300 volts, or the box shall be equipped with permanently installed barriers between adjacent switches. Where wall switches for normal system and emergency system are grouped or ganged in an outlet box, permanently installed barriers shall be provided in the outlet box to separate the normal and emergency systems.

T. Approved thread lubricant containing powdered zinc or lubricating graphite shall be applied to the male threads only of aluminum conduit to prevent joint seizure.

U. Other routings than those indicated may not be used without the approval of the Architect, but the Contractor shall make allowance for possible obstruction to routes indicated.

V. In the Founders Building, for sleep lab, certain areas and hollow spaces between suspended ceilings and slabs above are being used for environmental air and electrical work therein shall be in accordance with Article 300.22 of the National Electrical Code and the local building code.

W. Raceways shall be supported in accordance with the National Electrical Code for the particular type of raceway; however, for rigid metal conduit and electrical metallic tubing, the maximum spacing between supports shall not exceed ten feet.

X. Wall switches indicated by doors shall be located on the strike side (lock side), 6" maximum from door frame to the side of the outlet box; however, for double doors switches shall be located where shown, usually clear of the door in the full open position.

Y. The Contractor shall install additional boxes or fittings in raceways as required to properly install conductors. The locations of these boxes or fittings shall be subject to the Architect's approval.

Z. In multi-section panelboards, circuit breakers, fusible switches, and spaces shall be divided equally between sections (unless indicated otherwise).

AA. Where fuses (or circuit breaker) are used with magnetic starters, control panels, contactors, etc., the Contractor shall reduce ampere rating of fuses (or circuit breaker) to be installed (from the sizes indicated) to the maximum ratings indicated on the nameplates of the magnetic starters, control panels, contactors etc. (or equipment containing these components). These ratings shall also be increased as necessary to comply with NEC paragraph 430.52(c)(1), exception 2.

BB. Suitable waterproof cable identification tags shall be installed on each power feeder in each pull (junction) box.

CC. Where conductors without raceway penetrate smoke partitions and/or fire rated partitions and floors, a UL listed fire-stop putty such as Nelson Flameseal shall be installed around the conductors. This fire-stop putty shall also be installed in conduit and EMT sleeves through smoke partitions and/or fire rated partitions and floors.

DD. Where roof penetrations are required for conduits supplying roof-mounted HVAC equipment, these penetrations shall be of the piping roof curb type per National Roofing Association standards.

EE. Where electrical work penetrates or is installed in fire and/or smoke partitions, this work shall be installed per UL standards. Contractor shall use fire rated putty pads as necessary.

3.2 WIRING IN CONDUIT (APPLIES ALSO TO E.M.T.)

A. Where several conduits (concealed and/or exposed) are run parallel to each other, they shall be grouped together on P-1000 galvanized Unistrut, with suitable clamps, which shall be attached to the wall or hung from the roof or structural ceiling. Where exposed conduit is indicated, the conduit shall be installed parallel with or at right angles to the building walls and/or ceiling (roof) and shall be supported adequately by pipe straps or other approved devices. Where a single conduit is run exposed in a damp and/or wet location, Mineralac straps of the type which permit a 1/4" air space between the conduit and the wall should

be used. Fastening of conduit shall be as follows: to wood by means of screws; to masonry by means of threaded metal inserts, metal expansion screws, or toggle bolts; and to steel by means of machine straps, bolts, or power actuated fasteners. Raceway fasteners shall be approved for the purpose (tie wire shall not be used).

B. Conduits which must cross building expansion joints shall, where practicable, cross same in furred ceilings areas rather than in slabs or walls, arranged with sufficient flexibility to accommodate the building expansion. However, where such routing is not possible, expansion fittings as manufactured by OZ Electrical Manufacturing Company shall be provided in each raceway attached to the structure whenever the raceway crosses an expansion joint. Expansion fitting shall be installed on one side of the joint with its sliding sleeve end flush with the joint and with a length of bonding jumper in the expansion joint equal to at least three times the normal width of the joint. Each expansion fitting shall be zinc-coated steel and contain heavy factory installed packing and internal copper braid packing and shall be complete with UL approved bonding jumper.

C. Conduits shall be kept at least 6" from runs of hot water piping, flues, or other hot object.

D. Where conduits rise through a concrete floor, the curved portion shall not be visible above the finished floor.

E. Where conduit fittings are installed, these shall be Crouse-Hinds or Appleton cast type.

F. Connectors and couplings for electric metallic tubing shall be of the compression type. Couplings for rigid heavy wall conduit shall be of the threaded type; two locknuts and one bushing shall be provided where heavy wall conduits enter boxes or equipment. Flexible metal conduit connectors shall be of the squeeze type with screw and locknut. Liquidtight connectors shall be compression type.

G. Insulated bushings shall be provided for conductors #4 and larger.

H. From each flush panelboard and cabinet (including fire alarm control panels, telephone cabinets, etc.), provide three empty 3/4" conduits to elbow out 6" into space above ceiling for future use.

I. No wires shall be pulled in until the conduit system is complete. Only Ideal "Yellow 77" or other approved type pulling lubricant shall be used.

J. During construction outlet boxes and conduit stub-ups shall be suitably protected against the entrance of foreign materials.

K. Conduit in suspended ceilings shall be located, where practicable, in the space between the ceiling and the concrete slab above. Raceways shall not be attached to (or supported by) the tie wires used to support the suspended ceilings and/or independent tie wires used to support only raceways. Raceways shall not be installed immediately above accessible acoustical ceiling (restricting tile removal) without written approval of Architect for the specific location. Raceways shall also not be installed in such a manner to restrict or block access to plenums, equipment, etc.

L. Where raceways pierce walls of HVAC housings, these penetrations shall be made per requirements of the HVAC housing manufacturer.

M. Raceways shall not be installed within 24" of VAV units, fan-powered boxes, and other mechanical equipment located above ceilings, except for those raceways that serve these units. Raceways shall be located to allow maintenance personnel to remove ceiling tiles below these spaces to service this equipment.

3.3 WIRING IN SURFACE METAL RACEWAY

A. Surface metal raceways may be used only where indicated and where wiring is to be installed on existing masonry walls that cannot be fished. Surface metal raceways shall be of the removable cover type with smooth surface sized as required for the wiring and installed parallel with or at right angles to the building walls. Fittings and boxes compatible with the raceway and of the same manufacturer shall be used as required. The raceway shall be adequately supported by the appropriate clips of the same manufacturer. Raceways shall be approved for use under NEC Article 386. Exposed parts of the raceway system shall be painted to match the existing surface to which it is installed.

B. The raceway system shall be installed flat against ceilings and walls in a neat manner.

3.4 GROUNDING

A. The metallic raceway system and the neutral conductor of the wiring systems are grounded at the service equipment (including emergency service equipment).

B. At each point of voltage transformation (including but not limited to transformers and inverters), the secondary neutral conductor and the secondary raceway system shall be grounded with a common insulated ground conductor as described in Article 250.30 of NFPA 70, National Electrical Code. The grounding electrode conductor described therein shall be continuous (no splices) and shall be in a raceway. Where the raceway routing is via finished areas, it shall be run concealed. Ground connection shall be visible. Where water pipe connection is used, connection of raceway and conductor to a water pipe shall be made with an approved ground connector similar to T & B conduit hub and water pipe clamp.

C. Grounding bushings with bonding jumpers shall be used around concentric or eccentric knockouts on equipment.

D. Grounding pole of each polarized receptacle (non-isolated ground type) shall be bonded to its outlet box with conductor sized in accordance with Table 250.122 of the National Electrical Code and a machine or self-tapping screw, unless the receptacle is of the approved self-grounding type.

E. In hospital, all receptacles and non-current carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact in patient care areas, operating at over 100 volts, shall be grounded by green insulated copper conductor, sized in accordance with Table 250.122 of the National Electrical Code, NFPA-70, and installed with the branch circuit conductors.

F. Grounding conductors used to bond across flexible metal conduits containing transformer secondary conductors shall be sized per NEC Table 250.66 based on size of the secondary conductors.

G. Each branch circuit and feeder shall be provided with a ground conductor installed with the circuit conductors. Each ground conductor shall be a green insulated copper conductor, sized in accordance with Table 250.122 of the National Electrical Code NFPA-70. These grounding conductors are not shown on the drawings.

H. Where water pipe grounding connection is made underground, a suitable plastic pipe sleeve and flush metal cover shall be installed to provide access to the connection.

I. Where ground connections are made in walls or inaccessible ceilings, access panels shall be installed. Access panels in walls shall be stainless steel.

J. See drawings for additional grounding requirements.

3.5 MOUNTING HEIGHTS

A. If not otherwise indicated, mounting heights to centerline of outlets shall be as follows:

1. Receptacles — 18" above floor.
2. Switches — 48" above floor.
3. Panelboards — not more than 5'6" from topmost operating handle to floor.
4. Bracket fixture — 7'0" above floor or, where mounted above exterior door, mirror or medicine cabinet, at a height just sufficient to clear the swing of the door or medicine cabinet.
5. Exit light — at a height just sufficient to clear the swing of the door, unless noted otherwise.
6. Fire alarm pull stations — 48" above floor.
7. Fire alarm visual units and audio/visual units — see Section 16600.
8. Telephone outlets — 18" above floor.
9. Computer outlets — 18" above floor.
10. Volume controls — 48" above floor.
11. TV outlets — 18" above floor.

B. The above mounting heights may be adjusted as required to permit bottom or top of plate to align with mortar joints in unfinished masonry walls, provided joints are not raked. Where joints are raked, adjust height as required to insure that center of outlet box will be in the center of masonry unit. Where outlets at different levels are shown adjacent, they shall, where possible, be installed on a common vertical centerline. Where these adjustments are made, 18" shall be the minimum mounting height for receptacles, telephone outlets, and computer outlets.

3.6 MARKING OF STARTERS, SAFETY SWITCHES, AND PANELBOARDS

A. Each panelboard, transformer, enclosed circuit breaker, automatic transfer switch, contactor, magnetic starter, combination magnetic starter and fused safety switch units, and safety switch, regardless of location, shall be suitably identified by means of 1/4" high letters cut in white laminated phenolic strip to show black letters. Strip shall be attached to cover by means of two screws. Device plate for each flush manual starting switch and wall switch used as starting switch or safety switch shall be suitably engraved to identify the equipment controlled. Device plate for each switch for heat trace cable connection shall also be engraved.

B. A permanent plaque/directory (white laminated phenolic to show black letters) shall be provided at each service disconnect location denoting all other services, feeders, and branch circuits supplying the building.

C. A sign shall be provided at service disconnect location indicating type and location of on-site emergency power sources.

3.7 WORK IN CRITICAL CARE AREAS

A. Critical care areas shall include SICU and MICU rooms and associated toilet rooms.

B. Contractor shall furnish and install room ground points where indicated. Each room ground point shall be provided to maintain a common electrical potential between non-electrical metal equipment and furniture near patients, bracket mounted lighting fixtures, and all metal structural surfaces which might be within the reach of any persons, who, in turn, might be able to touch the patient. This grounding point shall consist of a highly conductive bare metal containing at least one approved terminal for grounding all exposed metal structural surfaces, e.g. - gas pipes, suction pipes, water pipes, heating pipes, door frames and window frames, or conduits which may be within reach of a patient or of persons who may touch him. At least three spare terminals shall be provided.

C. Grounding of metal raceways shall be assured by means of grounding bushings on all conduit terminations at the panelboards and by means of insulated continuous No. 12 AWG stranded copper grounding wire extended from the ground bus in the panelboard to the conduit grounding bushings.

D. Grounding of metal switches and receptacle plates shall be provided by means of the mounting screw connections to the device mounting yokes.

E. Grounding of exposed metal parts of piping, door framing, plumbing fixtures, and any other structural equipment within reach of the patient or of the personnel serving the patient, shall be secured by installation of insulated continuous No. 10 AWG stranded copper grounding conductors from the grounding studs of the room grounding point to the metal parts with connections made by means of approved copper or brass straps, clamps and lugs.

F. Each room ground point shall consist of two 18" x 18" x 8" D screw cover junction boxes installed above accessible ceiling and nipped together with 1" raceway. Covers shall be facing down. Provide a 1/4" x 1" x length as required (17" minimum) copper bus bar in each box mounted on 1/4" spacers.

Provide lugs on bus bars for all branch circuit ground conductors and building equipment ground conductors (emergency circuits through one box and normal circuits through other box). Connect the two bus bars using #1/0 THHN through the nipple. Connect one bus bar using #1/0 THHN in 1" conduit to nearest cold water pipe that is 1" minimum in diameter. Provide phenolic nameplate on covers to read "Room Ground Point". The ground conductor, routed with each branch circuit run through the room ground point shall be connected to the ground bus.

3.8 WORK IN PATIENT CARE AREAS

After the work is completed in patient care areas, the Contractor shall provide grounding system testing as indicated in NFPA 99-2002, Section 4.3.3.1. and receptacle testing as indicated in NFPA 99-2002, Section 4.3.3.2. The test reports shall be provided to the Architect.

END OF SECTION

SECTION 16400

ELECTRICAL SERVICE AND DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

Work described in this Section includes providing labor, materials, and equipment indicated, specified, and necessary for a complete and operating distribution system and related systems, in accordance with SECTION 16010 - ELECTRICAL GENERAL PROVISIONS.

1.2 APPLICABLE PARAGRAPHS

Applicable paragraphs of SECTION 16100, ELECTRICAL BASIC MATERIALS AND METHODS, shall apply to this Section as though repeated herein.

1.3 EQUIPMENT LOCKS

Panelboards, cabinets, and other electrical equipment having doors with locks, shall be keyed alike.

1.4 SERVICE EQUIPMENT

Safety switches, panelboards, and switchboards used as service equipment shall be Underwriters Laboratories listed and labelled for the application.

PART 2 - PRODUCTS

2.1 LIGHTING BRANCH CIRCUIT PANELBOARDS (120/208V)

A. Unless noted otherwise boxes shall be approximately 20" wide by 5 $\frac{3}{4}$ " deep with 5" minimum side and end gutters. Boxes shall be constructed of code gauge galvanized steel. Feed-through panelboards shall have an additional 4" of side gutter on one side.

B. Fronts shall be for flush or surface mounting as indicated and shall be complete with door and flush chrome-plated combination cylinder lock and catch. Fronts shall be full finish code gauge steel with prime coat and finish coat of baked enamel in manufacturer's standard color, with concealed adjustable trim clamps and directory with transparent covers. Door shall have concealed hinges.

C. Bussing shall be copper, and lugs or main breaker, and branch circuit breakers shall have ampere ratings indicated. Breakers shall be connected to the bus in a sequence phase arrangement using full size breakers (double module breakers shall not be used).

D. Two-pole and three-pole breakers shall have common trip. Branch circuit breakers shall be of the bolted type, quick-make, quick-break, thermal magnetic, 10,000 amp minimum interrupting capacity at 250 volts a.c. Trip position shall be between the "on" and "off" positions to positively identify faulted or overloaded circuits from "off" circuits. Where specifically indicated, breakers shall be complete with ground

fault circuit interrupter. 15A and 20A one-pole breakers shall be approved for switching duty. Where used to switch H.I.D. lighting, circuit breakers shall be rated (calibrated) to properly carry the inrush current (labeled "HID"). Where used to switch fluorescent lighting, they shall be labeled "SWD" or "HID".

E. Panelboards shall be Square D type NQOD, or equal, factory assembled. Equal equipment as manufactured by GE, Cutler Hammer, or Siemens will be acceptable.

2.2 LIGHTING BRANCH CIRCUIT PANELBOARDS (277/480V)

A. Boxes shall be approximately 20" wide by 5 $\frac{3}{4}$ " deep with 6" minimum side gutters and 7 $\frac{1}{2}$ " minimum end gutters, and shall be constructed of code gauge galvanized steel. Feed-through panelboards shall have an additional 4" of side gutter on one side.

B. Fronts shall be flush or surface mounted as indicated and shall be complete with door and flush chrome-plated combination cylinder lock and catch, with locks keyed alike. Fronts shall be full finish code gauge steel with prime coat and finish coat of baked enamel in manufacturer's standard color, with concealed adjustable trim clamps and directory with transparent covers. Doors shall have concealed hinges.

C. Bussing shall be copper, and lugs or main breaker, and branch circuit breakers shall have ampere ratings indicated. Breakers shall be connected to the bus in sequence phase arrangement using full size breakers (double module breakers shall not be used).

D. Two-pole and three-pole breakers shall have common trip. Branch circuit breakers shall be of the bolted type, quick-make, quick-break, thermal magnetic, 18,000 amp minimum interrupting capacity at 277 and/or 480 volts a.c. Trip position shall be between the "on" and "off" positions to positively identify faulted or overloaded circuits from "off" circuits. 15A and 20A one-pole breakers shall be approved for switching duty. Where used to switch H.I.D. lighting, circuit breakers shall be rated (calibrated) to properly carry the inrush current (labeled "HID"). Where used to switch fluorescent lighting, they shall be labeled "SWD" or "HID".

E. Panelboards shall be Square D type NF, or equal, factory assembled type. Equal equipment as manufactured by GE, Cutler Hammer, or Siemens will be acceptable.

2.3 FUSIBLE DISTRIBUTION PANELBOARDS

A. Boxes shall be constructed of code gauge galvanized steel.

B. Fronts shall be surface mounting and shall be four-piece construction, without door. Sections over side wiring gutters shall be easily removable independent of top and bottom gutters.

C. Fronts and boxes shall be finished with primer coat and then a coat of baked enamel in manufacturer's standard color.

D. Fusible switch units shall be of the quick-make, quick-break type, front operated by sturdy cast aluminum handles. Each switch shall be enclosed in a steel box. 30 through 100 ampere units shall be mounted as twin units. Units shall have an interlock to prevent opening the unit while the switch is in the "on" position; provision shall be made to permit release of this interlock with a screwdriver and opening the unit while the circuit is on, so that fuses may be checked without breaking the circuit. Units shall be dual horsepower rated. Fuse clips shall be of copper, having positive pressure, reinforcing springs which

automatically grip the fuses. Each switch shall be provided with a white micarta nameplate with black-cut letters. 600 ampere and smaller switches shall be complete with rejection feature to insure rejection of fuses other than Class R. Each switch shall have provisions for padlocking in "OFF" position only, with up to three padlocks.

E. Interiors shall consist of insulated bus bars mounted on a fabricated steel pan which is drilled and tapped to receive any combinations of units. Main bus bars shall extend over the entire pan. Neutral shall be provided unless otherwise indicated. Bus bars shall be copper and sizes shall be based on a current density of 1000 amperes per square inch.

F. Panelboards shall be Square D QMB factory assembled type. Equal equipment as manufactured by GE, Cutler Hammer, or Siemens will be acceptable.

2.4 CIRCUIT BREAKERS

A. Each circuit breaker shall have continuous current rating visible without removing an enclosure cover, and the rating shall be engraved. This may be accomplished by installation of a phenolic label (white with black cut letters) adjacent to the circuit breaker. Circuit breakers shall be suitable for use with 75 degree C conductors. Where circuit breakers are used to supply HVAC equipment having motor group combinations, type HACR circuit breakers shall be used. Circuit breakers installed in existing panelboards or switchboards shall be of the proper type to be installed therein, shall include bussing kits/alterations as required, and shall have an interrupting capacity of not less than that of the existing circuit breakers. Where circuit breakers are not available to fit existing panelboard, panelboard shall be removed and replaced with new.

B. Unless indicated otherwise, circuit breaker spaces and spare circuit breakers shall be divided equally between sections of multi-section panelboards.

C. Where ground-fault protection is provided for 3-pole circuit breakers (or fusible switches), performance testing of the ground fault protection system shall be provided after installation. Written documentation for this test shall be provided to the Engineer.

D. Where a circuit breaker with adjustable long time trip (where cover over adjustment is not lockable per NEC 240.6 (c)) is used, conductor size for the protected feeder shall be increased by the Contractor to match maximum long time setting of the circuit breaker.

E. Circuit breakers in panelboards shall be fully rated for AIC; that is, series ratings are not acceptable.

2.5 DRY TYPE TRANSFORMERS

A. Transformers shall be "watchdog" type as manufactured by Square D for 480 volt 3-phase delta to 120/208 volt, 4-wire, 3-phase, wye, unless noted otherwise, with 4 - 2½% FCBN and 2 - 2½% FCAN taps. Three phase transformers shall have Class 220 insulation rating with 115° C rise. Transformers shall have built-in vibration dampening system, and sound level shall not exceed 45 db.

B. Unless noted otherwise on drawings, transformers 30 KVA and below shall be wall mounted, and transformers above 30 KVA shall be floor mounted on 3" high concrete base reinforced with 6 x 6 - 6/6wwf. Where walls cannot properly support transformer, galvanized strut frames supported to floor and ceiling structure shall be provided to support transformers.

C. Unless noted otherwise on drawings, transformers installed indoors shall have ventilated enclosures; transformers installed outdoors shall have totally enclosed enclosures approved for outdoor applications or shielded, ventilated enclosures approved for outdoor applications.

D. Equal equipment as manufactured by GE or Cutler Hammer will be acceptable.

PART 3 - EXECUTION

3.1 UNDERGROUND MAIN SERVICE

A. Existing main services are 4-wire, 3-phase, 277/480V are to remain.

3.2 EMERGENCY LIGHTING SYSTEM

A. Emergency fixtures shall have at least two lamps or ballasts, each on a separate circuit, or, if one lamp or one ballast, shall be wired so that adjacent fixtures are on alternate circuits. Exit fixtures shall have two lamps, each on a separate circuit. Wiring shall be kept entirely independent of any other wiring and equipment and shall not enter the same fixture, raceway, box or cabinet with other wiring.

B. Exit fixtures shall not be switched.

END OF SECTION

SECTION 16500

ELECTRICAL LIGHTING

PART 1 - GENERAL

1.1 SCOPE

Work described in this Section includes labor, materials, and equipment indicated, specified, and necessary for a complete and operating lighting system and related systems in accordance with SECTION 16010 - ELECTRICAL GENERAL PROVISIONS.

1.2 APPLICABLE PARAGRAPHS

Applicable paragraphs of SECTION 16100 - ELECTRICAL BASIC MATERIALS AND METHODS, shall apply to this Section as though repeated herein.

PART 2 - PRODUCTS

2.1 EXIT LIGHTS

A. Exit lighting fixtures shall be Lithonia LQM series with red letters on a stencil, 2 circuits. Stencil and exposed parts shall be polycarbonate housing. Housing shall have white finish and stencil shall have white finish. Each fixture shall have concealed LED's. Units shall be rated for dual voltage 120/277V. Housing thickness shall be maximum 1 15/16". See symbol schedule on drawings for mounting details. Fixtures shall meet NFPA 101, with chevron style arrows. For sleep lab, new exit lighting fixture shall match existing exit lighting fixtures in existing suites..

2.2 OTHER FIXTURES

- A. Other fixtures shall be as specified in schedule on drawings.
- B. Fluorescent fixtures with multiple lamps shall have lamp sockets arranged so that lamps are equally spaced to provide uniform lamp appearance.
- C. Fixtures to be installed in damp or wet locations shall be labeled by Underwriters' Laboratory for that purpose.
- D. Recessed incandescent fixtures shall be provided with thermal protectors to automatically deactivate the fixtures due to overheating (fixtures shall be labeled by Underwriters' Laboratory for that purpose).
- E. Fixtures shall be finished (painted or other finish as specified) after fabrication.
- F. Where the lamp manufacturer indicates possible hazardous conditions caused by lamp breakage, fixtures shall contain protective lenses and/or screens to contain parts of broken lamps.

2.3 LAMPS

A. Lamps shall be General Electric, Philips, or Sylvania. Unless otherwise indicated in fixture schedule, fluorescent lamps shall be T-8, instant start type. Degree K color of lamps shall be as directed by hospital.

B. Where existing fixtures are to be relocated or removed and reinstalled, each shall be completely relamped using new lamps.

C. Lamps shall be furnished and installed for fixtures as work of this Division, including fixtures furnished as work of other Divisions.

2.4 BALLASTS

A. Ballasts for fluorescent lamps shall be energy saving, electronic type, Class P, high power factor, full light output type, instant start, parallel lamp operation, 20 KHz minimum, THD of less than 20%, minimum ballast factor of 0.85 for four T-8 lamps and minimum ballast factor of 0.88 for two and three T-8 lamps, manufactured by Advance, Universal, or equal. Ballasts shall be suitable for temperature range at the fixture locations.

B. Ballasts for HID lamps shall be high power factor, constant wattage or constant wattage autotransformer, low noise level, and shall be furnished by the manufacturer of each type of particular lighting fixture specified.

C. Ballasts for compact fluorescent lamps shall be high power factor electronic type.

PART 3 - EXECUTION

3.1 SUPPORTS

A. For any type ceiling which itself does not provide sufficient support for fixtures, either arrange with other subcontractors to strengthen ceiling or support fixtures from structure above independently of ceiling.

B. Suspended fluorescent fixtures in continuous rows shall have one stem at the beginning of the row, one stem at each channel joint, and one stem at the end of the row.

C. Fluorescent fixtures mounted individually on stems shall each have two single stem hangers. Fluorescent fixtures individually surface mounted shall be supported at both ends.

D. Fluorescent fixtures surface mounted in continuous rows shall have one support at the beginning of the row, one support at each channel joint, and one support at the end of the row.

E. Recessed fixtures installed in plaster ceilings and gypsum board ceilings (including ceilings with glue-on acoustical tiles) shall be furnished with metal plaster frames or other suitable mounting frames.

F. Recessed fixtures shall be so adjusted to their supports that their trim flanges fit tightly and evenly against the surface of the ceiling.

G. In acoustical tile ceilings with concealed mechanical suspension systems, recessed fluorescent fixtures (troffers) shall be hung from suitable supporting channels. The placing of the supporting channels by other subcontractors must be coordinated so that they run in the same direction as the lamps and so that one channel will be where a troffer is to be installed and, then, in order to support the troffer, an additional channel must be installed by these other subcontractors, spaced the proper distance from the first mentioned channel. This Contractor shall cooperate with and advise these other subcontractors as to the exact location of channels desired. After the required channels are in place, troffers shall be supported from the channels by means of the adjustable suspension brackets which shall be used.

H. In acoustical tile ceilings with exposed mechanical suspension systems, recessed fluorescent fixtures shall be lay-in type. Fixtures so supported shall be securely fastened to the ceiling's framing member by approved fixture support clips (4 required per fixture). Metal fixture appendages that simply fold down over the ceiling's framing members are not acceptable. Arrange with other subcontractors to support ceilings at each corner of each of these fixtures (not more than 6 inches from each corner).

3.2 LOCATION OF FIXTURES

A. Work of this Section includes advising other trades of exact location of recessed fixtures so that ceiling construction and/or spacing may be coordinated as necessary to permit symmetrical positioning of fixtures in room.

B. For acoustical tile ceilings, surface and/or suspended fixtures shall be centered on a tile or a tile joint, unless indicated otherwise.

C. The locations of fixtures in Mechanical Equipment Rooms and Electrical Rooms are approximate. The Contractor shall determine exact locations based on exact locations of mechanical equipment for optimal lighting.

D. 2'x2' fluorescent fixtures shall be oriented so that all lamps are oriented in the same direction as other 2'x2' fixtures and 2'x4' fixtures in the area.

3.3 INSTALLATION AFTER PAINTING

Fixtures to be installed in or on painted ceilings and/or walls shall not be installed until painting is completed. Fixtures installed with paint applied over factory finishes will be rejected.

3.4 PROCEDURE

The Contractor shall demonstrate to the Owner at his convenience the proper procedure for relamping each type of fixture.

3.5 CLEARANCE

Thermal or acoustic insulation shall not be installed over the top or within 3 inches of the sides of a recessed (incandescent, HID, or compact fluorescent) fixture enclosure, wiring compartment, or ballast unless the equipment is labelled for the purpose. Thermal or acoustic insulation shall not be installed over the top of a recessed fluorescent fixture. Work of this Section includes advising other trades of this requirement, so that proper clearances are maintained.

3.6 FIXTURE COORDINATION

Lighting fixture submittal shall include data on each type of ceiling suspension system and associated acoustical tile. Information on the ceiling suspension systems shall include types of recessed fluorescent fixture suitable for use with each type as well as recommended installation details.

END OF SECTION

SECTION 16600

ELECTRICAL SPECIAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

Work described in this Section includes providing all labor, materials, and equipment indicated, specified, and necessary for complete and operating systems in accordance with SECTION 16010 - ELECTRICAL GENERAL PROVISIONS.

1.2 APPLICABLE PARAGRAPHS

Applicable paragraphs of SECTION 16100 - ELECTRICAL BASIC MATERIALS AND METHODS, shall apply to this Section as though repeated herein.

1.3 SYSTEMS INVOLVED

Systems involved include the following:

1. Fire Alarm System (Hospital)
2. Fire Alarm System (Sleep Lab)
3. Raceways for Telephone/Computer/CATV Outlets
4. Paging System (Hospital)
5. Nurse Call and Code Blue System (Hospital)
6. Intercom System (Sleep Lab)

1.4 FIRE ALARM SYSTEM SUBMITTALS

A. Contractor shall have a certified fire alarm installer prepare equipment brochures, plan view and one line schematic shop drawings for the work of this contract.

B. Equipment brochures shall consist of items specified hereinafter and items that are pertinent to the work. The brochures shall include a sequence of operation, battery calculations, and statement identifying "type of system". These brochures shall be submitted for review per paragraph 16010.2.3. Where remote station monitoring is required, brochures shall provide the name of the monitoring company (which must be Fire Marshal approved).

C. Shop drawings shall indicate sizes, quantities, and types of conductors, cables and raceways and details necessary to install the work.

D. Contractor shall submit the following to the Architect for Fire Marshal review:

1. Six sets of the reviewed equipment brochures.
2. Six sets of shop drawings and one set of reproducibles.
3. Completed Louisiana State Fire Marshal's plan review form.
4. Check for review fee, if applicable.

E. If additional clarifying details and/or components are required by the Fire Marshal, Contractor shall prepare the details, provide components, and secure approval at no additional cost to the Owner. Installation shall not begin until the Fire Marshal's review is complete.

F. Operating instructions provided to the Owner shall include submittal brochure, shop drawings, and booklet including device addresses to match shop drawings, and control commands for doors, HVAC, elevators, etc.

PART 2 - PRODUCTS

2.1 FIRE ALARM SYSTEM (HOSPITAL)

A. There is an existing Johnson Controls fire alarm system with a Notifier control panel that shall be reused and expanded as required. Contractor shall furnish and install smoke detectors, air-stream smoke detectors, heat detectors, manual stations, signals, monitor modules, control modules with relays, remote power supplies, batteries, wiring and raceways, and all other equipment, whether specifically indicated or not, to provide a complete and operating addressable analog, non-coded, supervised fire alarm system to meet the requirements of NFPA 72 and all other applicable Life Safety Codes.

B. Contractor shall provide wiring as recommended by the manufacturer and it shall be indicated in the point-to-point interconnection drawings that shall be included with the submittals. The completed installation is to conform to applicable sections of NFPA 72, local and state code requirements and the National Electrical Code. Entire system shall have battery backup to meet NFPA and local codes plus 20% spare capacity.

C. Manual stations shall be addressable, double action type, metal or Lexan housing with red finish on flush outlet box. Where surface mounting is allowed, a full size backbox made specifically for manual stations shall be used. Backbox color shall be red to match manual station.

D. Smoke detectors shall be photoelectric, low profile, addressable, analog type with base mounted on flush outlet box. Smoke detectors shall communicate actual smoke chamber values to the system control panel. Sensors shall be listed to UL 268. Sensors shall be listed as compatible with the control equipment and shall, in combination with this control equipment, be able to generate sensitivity reports acceptable to the Authority Having Jurisdiction as automatically meeting NFPA sensitivity testing requirements. Sensors shall be fully field programmable for sensitivity levels and indicate when maintenance is required. Each sensor base shall contain an LED that will flash each time the detector is scanned. LED shall also indicate when the sensor is in alarm. Where surface mounting is allowed, a round backbox that is slightly larger in diameter than the detector base shall be used.

E. Air-stream smoke detectors shall be addressable analog detectors. Performance shall be as described for smoke detectors. A remote test station (with indicator light and keyed test switch on a single-gang plate to be engraved with associated air unit designation) shall be provided for each air-stream smoke detector. Each shall be in a flush outlet box at a location as directed (generally) in corridor wall near the detector or at a readily accessible place in the associated mechanical room, unless a location is indicated on the drawings. Provide wiring in raceways from detector(s) to remote test station (test station shall not be addressable device with a different address than the detector). Provide a control module with relay at the air handling system associated with each air-stream smoke detector and program it for fan/damper shutdown control resulting from activation of that detector. Where not part of Division 15 work, provide wiring and raceways from control module relays so that each air-stream smoke detector will provide fan shutdown and, where applicable, closure of smoke damper for only the associated HVAC system (i.e., other HVAC systems shall not be controlled by this air-stream smoke detector or by the fire alarm control panel unless indicated otherwise). Air-stream smoke detectors shall be as follows:

1. Where air-stream to be sensed passes through a duct, the air-stream smoke detector shall be a duct type smoke detector with housing and air sampling tubes. These shall be located in accordance with NFPA 72 requirements with exact location to be coordinated with the Division 15 contractor. Multiple duct smoke detectors shall be provided at each location where ducts split into multiple ducts that cannot be monitored by a single detector.

2. Where air-stream to be sensed does not pass through a duct, the air-stream smoke detector(s) shall be located in accordance with NFPA 72 paragraphs 5.14.4.2.2 and A.5.14.4.2.2 and shall be of the type (and quantity) suitable and UL listed for the application (including air velocity).

F. Heat detectors shall be used where indicated and in lieu of smoke detectors where moisture will cause the smoke detectors to malfunction. Each shall be addressable and shall be rate-of-rise or fixed temperature type as appropriate. Where used in association with elevator sprinkler heads, they shall be fixed temperature type with temperature lower than sprinkler head temperature and one shall be located within two feet of each head. Where surface mounting is allowed, a round backbox that is slightly larger in diameter than the detector base shall be used.

G. Bases for addressable smoke detectors shall be identical to bases for addressable heat detectors so that smoke detectors can be changed by simply unplugging the smoke head and plugging in a heat head. The system shall automatically recognize the new device and operate on a default program designed for the new device. The Fire Alarm Control Panel shall automatically be notified of any device changes and the exact location of these changes.

H. Provide a small permanent label on each addressable device to indicate the address.

I. Audiovisual signal units shall be wall mounted chimes with strobe lights with red plate/housing as directed by hospital. Strobe lights shall be xenon flasher, with the word "FIRE" and shall be ADA compatible and listed to UL 1971. Units shall be mounted on flush outlet boxes. Where surface mounting is allowed, a red full size backbox made specifically for these signal units shall be used. Mounting height to the bottom of the device lense shall be 80" above the highest floor level within the space. Strobe intensity at each location shall be selected to meet ADA and NFPA 72. Where there are more than two units in a space, units shall flash in synchronization. Audio unit shall be selected to provide adequate volume at each location.

J. Visual signal units shall be xenon flasher on a red plate/housing as directed by hospital with the word "FIRE", shall be ADA compatible, and shall be wall mounted on flush outlet boxes. Where surface mounting is allowed, a red full size backbox made specifically for these signal units shall be used. Mounting height shall be the same as audiovisual signal units. Strobe intensity at each location shall be selected to meet ADA and NFPA 72. Where more than two in a space, units shall flash in synchronization.

K. Provide addressable monitor modules for each sprinkler flow switch, sprinkler valve supervisory switch, fire suppression release panel, and for other equipment as shown. Provide wiring in raceways from monitor modules to the equipment to be monitored. Modules shall communicate any change in status to the fire alarm control panel (alarm for flow switches, fire suppression release panels, and trouble for valve supervisory switches, and fire suppression release panels.

L. Provide addressable control modules at air handling systems (as hereinbefore indicated), at door control panels (quantity as required), electrically operated doors, and for other equipment as indicated on the drawings. Provide wiring in raceways from control modules to the equipment to be controlled; observe distance limitations required in NFPA 72. Provide custom programming as required.

M. Programming shall be provided as required to suit new fire alarm system work.

N. The existing control panel with batteries, power supplies, door hold-open panel, etc., is located in existing PBX room on first floor of hospital. The system is monitored by an existing CRT located in the engineering office and has a printer for written report on the status of the system. The fire alarm panel is connected to existing security system for remote monitoring.

O. Circuit continuity for the fire alarm system on the third floor shall be maintained. Provide wiring, raceways, junction boxes, etc., to suit.

P. Provide remote power supply panels in closets as necessary for new devices. Provide a 120 volt emergency (life safety branch) branch circuit for each. Also provide a smoke detector in each closet containing a remote power supply panel and/or control panel.

Q. Modifications shall be made as necessary to accommodate the existing remote annunciators and programming for main control panel, CRT, and printer.

2.2 FIRE ALARM SYSTEM (SLEEP LAB)

A. There is an existing fire alarm system that shall be reused and expanded as required. Contractor shall furnish and install smoke detectors, signals, wiring and raceways, and all other equipment, whether specifically indicated or not, to provide a complete and operating fire alarm system addition to meet the requirements of NFPA 72 and all other applicable Life Safety Codes.

B. Contractor shall provide wiring as recommended by the manufacturer and it shall be indicated in the point-to-point interconnection drawings that shall be included with the submittals. The completed installation is to conform to applicable sections of NFPA 72, local and state code requirements and the National Electrical Code. Entire system shall have battery backup to meet NFPA and local codes plus 20% spare capacity.

C. Alterations to control panel and programming shall be provided if required.